Total Credits= 24

3rd Semester		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCHMS1-301	Molecular Spectroscopy-II	4	0	0	40	60	100	4
MCHMS1-302	Quantum Chemistry	4	0	0	40	60	100	4
MCHMS1-303	Heterocyclic Chemistry	4	0	0	40	60	100	4
MCHMS1-304	Seminar – II	0	0	2	100	-	100	1
Departmental Elective-IV (Choose any one)		4	0	0	40	60	100	4
MCHMD1-311	Surface Chemistry & Catalysis							
MCHMD1-312	Medicinal Chemistry							
MCHMD1-313	Green Chemistry							
Open Elective-II		3	0	0	40	60	100	3
MCHMS1-305	Organic Chemistry Lab.-II	0	0	4	60	40	100	2
MCHMS1-306	Physical Chemistry Lab.-I	0	0	4	60	40	100	2
Total		**-**	**-**	**-**	**420**	**380**	**800**	**24**

Total Credits= 20

4th Semester		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MCHMS1-401	Photochemistry and Pericyclic Reactions	4	0	0	40	60	100	4
MCHMS1-402	Bio-inorganic Chemistry	4	0	0	40	60	100	4
MREM0-101	Research Methodology	4	0	0	40	60	100	4
MCHMS1-403	Physical Chemistry Lab.-II	0	0	4	60	40	100	2
Optional* (Choose any one)		0	0	8	60	40	100	4
MCHMS1-404	Dissertation							
MCHMS1-405	Term Paper							
MCHMS1-406	Advanced Lab	0	0	4	60	40	100	2
Total		**-**	**-**	**-**	**300**	**300**	**600**	**20**

Overall Marks / Credits

Semester	Marks	Credits
1st	700	23
2nd	700	23
3rd	800	24
4th	600	20
Total	**2800**	**90**

Departmental Elective: Subject to the availability of teacher and minimum 10 students as per university guidelines.

Open Elective: Student must choose open elective subject offered by other department.

Optional*:

Dissertation- Maximum 20% of the sanctioned strength of the students will be allotted dissertation on the basis of their option and percentage of marks (Merit) in M.Sc. Istyear examination subject to the consent of the faculty in the Department. Maximum students guided by each faculty cannot be more than two.

Term paper: The students who have not been allotted dissertation, will be offered term paper.

MOLECULAR SPECTROSCOPY-II

Subject Code: MCHMS1-301 **L T P C** **Duration: 60(Hrs.)**
4 0 0 4

Course Objectives:

1. To provide the knowledge of Proton Magnetic Resonance, Electron Spin Resonance and mass spectroscopy.
2. To familiarize the students with advanced NMR techniques like DEPT,COSY, HETCOR, NOESY etc.
3. To understand the difference between ^{1}H NMR and ^{13}CNMR.
4. To understand the utility of various spectroscopic techniques like UV, IR, NMR and mass spectroscopy for structure elucidation.

Course Outcomes:

The students will acquire knowledge of

1. Concepts of NMR, ESR and mass spectroscopy.
2. Advanced NMR techniques like DEPT,COSY, NOESY. HETCOR etc.
3. Differences between PMR and CMR.
4. Structural elucidation of molecules with UV, IR, NMR and mass spectroscopy.

UNIT-I (15 Hours)

Nuclear Magnetic Resonance Spectroscopy

The nuclear spin, precessional motion. Larmor frequency, the NMR isotopes, population of nuclear spin levels, spin – spin and spin – lattice relaxation, measurement techniques, Solvents used, Chemical Shift, shielding constant, range of typical chemical shifts simple applications of chemical shift ring currents and aromaticity, shifts of ^{1}H and ^{13}C, inductive effect, ring current effect and anisotropy chemical bonds, intermolecular forces effecting the chemical shifts. Spin – spin interactions, low- and high-resolution NMR with various examples. Heteronuclear coupling of ^{1}H to other nuclei such as nitrogen, phosphoros and fluorine oxygen and sulphur. spin – spin interaction. Interaction between two or more nuclei, splitting due to vicinal and germinal protons, Coupling constant- mechanism of coupling, one, two and three bond coupling, long range coupling. Karplus relationship

UNIT-II (15 Hours)

Nuclear Magnetic Resonance Spectroscopy (contd.)

First order and second spectra, spin system notation, A_2, AB, AX, AB_2,AX_2, ABC, ABX, $A_2B_2$and A_2X_2systems, magnetic equivalence, shifts reagents. Effects of chemical exchange, fluxional molecules, Hindered rotation on NMR spectrum,. Nuclear magnetic double resonance, spin decoupling, Nuclear Overhauser Effect (NOE), Advanced NMR techniques- COSY, HETCOR, NOESY

^{13}C-Nuclear Magnetic Resonance Spectroscopy

^{13}C- ^{1}H coupling, ^{13}C chemical shift, ^{13}C spectra- proton coupled and decoupled, Differences of ^{13}C from ^{1}H NMR, DEPT, Nuclear OverhauserEffect, Cross Polarization, Intensities of lines in ^{13}C, Problems with integration in ^{13}C spectra.

UNIT-III (15 Hours)

Mass Spectroscopy

Introduction, methods of ionization EI & CI, Laser desorption, Fast Atom Bombardment (FAB). Secondary Ion Mass Spectrometry (SIMS), field desorption etc. Ion analysis methods (in brief), isotope abundance, Metastable ions, Electron Impact mass spectra, fragmentation patterns for aliphatic compounds, amines, aldehydes, ketones, esters, amides, nitriles, carboxylic acids ethers, aromatic compounds, general rules predicting the fragmentation patterns.

UNIT-IV (15 Hours)

Electron Spin Resonance Spectroscopy

Introduction, Factors affecting g values, limitations of ESR, Comparison of ESR and NMR, Instrumentation, hyperfine structure- isotropic and anisotropic interactions, ESR spectra of Deuterium, Triplet states-zero field splitting and Kramer's degeneracy, McConnel relationship, Study of inorganic compounds by ESR

Structure Elucidation

Structure elucidation by combined application of UV, IR, NMR and mass spectra. Solving first 20 problems from reference book 6 and first 20 problems from reference book 8.

Recommended Text Books / Reference Books:

1. C.N. Banwell 'Fundamentals of Molecular Spectroscopy' 4thEdn., TataMcGraw-Hill Education,**1994**.
2. William Kemp, 'Organic Spectroscopy', 3rdEdn., W.H. Freeman,**1991**.
3. Dudley H. Williams & Ian Fleming, 'Spectroscopic Methods in Organic Chemistry', 6thEdn., McGraw Hill, Science,**2008.**
4. Russell S. Drago, 'Physical Method for Chemistry', 2ndEdn., SurfsideScientific Publishers,**1992.**
5. R.M. Silverstein, G.C. Bassler, T.C. Morrill, 'Spectrometric Identification of Organic Compounds', 3rdEdn., Wiley,**1974**.
6. D.L. Pavia, G.M. Lampan and G.S. Kriz, 'Introduction to Spectroscopy' 4thEdn., Cengage Learning, **2008**.
7. R.C. Banks, E.R. Matjeka, G. Mercer, 'Introductory Problems in Spectroscopy' Manlo Park, CA,**1980**
8. Jag Mohan, 'Organic Spectroscopy-principles and applications', 2nd Edn., Narosa Publishing house Pvt. Ltd., 2007

QUANTUM CHEMISTRY

Subject Code: MCHMS1-302 **L T P C** **Duration: 60(Hrs.)**
4 0 0 4

Course Objectives:

1. Master fundamental quantum mechanical principles and problem-solving techniques.
2. Develop working knowledge of terminology and tools used by quantum chemistry.
3. Learn how quantum mechanics manifests itself in nature and experimental science.
4. Understand advantages and limitations of approximation methods for solving complex problem

Course Outcomes:

The students will acquire knowledge of

1. Quantum mechanical principles
2. Approximate methods in quantum chemistry
3. Angular momentum and electronic structure of atoms
4. Working knowledge of terminology and tools used by quantum chemistry

UNIT-I (15Hrs.)

Quantum Mechanics: limitations of classical mechanics, Operators , Hermitian operators and their properties. Commutation relations. Wavefunctions and Eigenvalue Equations, Expectation Values. Postulates of quantum mechanics. Uncertainty Principle, Schrodinger wave equation. Discussion of solutions of the Schrodinger equation to some model systems viz., Particle in a box, The Harmonic Oscillator and tunneling.

UNIT-II (15 Hrs.)

Discussion of solutions of the Schrodinger equation to some model systems : The Rigid Rotor, The Hydrogen atom.
Approximate Methods: The Variation Theorem, Linear Variation Principle, Perturbation Theory (first order and non-degenerate). Applications of Variation Method and Perturbation Theory to the Helium atom.

UNIT-III (15 Hrs.)

Angular Momentum: Ordinary angular momentum, Generalized angular momentum, Eigen functions for angular momentum, Eigen values of angular momentum, Operator using ladder operators, Addition of angular momentum, Spin, Antisymmetry and Pauli exclusion principle. Electronic Structure of Atoms: Electronic configuration, Russell-Saunders terms and Coupling Schemes, Slater-Condon parameters, Term Separation Energies of the p^n Configuration, Term Separation Energies for the d^n Configurations, Magnetic Effects: Spin-orbit Coupling and Zeeman Splitting, Introduction to the methods of Self-consistent field, The Virial Theorem.

UNIT-IV (15 Hrs.)

Born-Oppenheimer Approximation: Hydrogen molecule ion. LCAO-MO and VB treatments of the Hydrogen molecule; Electron Density, Forces and their role in Chemical Binding. Hybridization and valence MOs of H_2O, NH_3 and CH_4. Huckel Theory of Conjugated Systems, Bond Order and Charge Density Calculations, Applications to Ethylene, Butadiene, and Cyclobutadiene.

Recommended Text Books / Reference Books:

1. P.W. Atkins and R.S. Friedman, 'Molecular Quantum Mechanics', 4th Edn., Oxford University Press,**2004**.
2. D. McQuarrie, 'Quantum Chemistry', '2nd Edn., University Science Books',**2008**.
3. I.N. Levine, 'Quantum Chemistry', 5th Edn., Prentice Hall,**2006**.
4. F.L. Pilar, 'Elementary Quantum Chemistry', McGraw Hill,**1968**.
5. N.H. March, 'Self-Consistent Fields in Atoms', Pergamon Press,**1975**.
6. A.K. Chandra, 'Introductory Quantum Chemistry', Tata McGraw Hill,**1988**.
7. J.A. Popleand D.L. Beveridge, 'Approximate Molecular-Orbital Theory', McGraw Hill, NY,**1970**.
8. J.P. Lowe, 'Quantum Chemistry', AcademicPress,**1993**.

HETEROCYCLIC CHEMISTRY

Subject Code: MCHMS1-303 **L T PC** **Duration: 60Hrs.**
4 0 0 4

Course Objectives

1. To familiarize with the structures of important classes of heterocyclic aromatic organic compounds.
2. To classify simple heterocyclic aromatic compounds as electron deficient or electronrich.
3. To explain the syntheses of electron deficient nitrogen containing heterocycles; pyridines, diazines and their benzo condensed analogs.
4. To explain the syntheses of electron rich nitrogen containing heterocycles; furans, thiophenes, 1,3-azoles and their benzo condensed analogs.

Course Outcomes:

After completion of the course the student will,

1. Be familiar with the structures of important classes of heterocyclic aromatic organic compounds,
2. Be able to classify simple heterocyclic aromatic compounds as electron deficient or electron rich and explain their reactivity based on these properties,
3. Know how selected organometallic reactions can be applied in heterocyclic chemistry,
4. Be able to explain on a mechanistic level, reactions and synthesis of important electron deficient nitrogen containing heterocycles; pyridines, diazines and their benzo-condensed analogs.

UNIT-I (15 Hrs).

Nomenclature of Heterocycles

Replacement and systematic nomenclature (Hantzsch Widman system) for monocyclic, fused and bridged heterocycles.

Aromatic Heterocycles

General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond length, ring current and chemical shifts in 1H NMR-spectra, empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltation). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

UNIT–II(15 Hrs).

Non Aromatic Heterocycles

Strain bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3 diaxial interaction. Stereo-electronic effects – anomeric and related effects. Attractive interactions – hydrogen bonding and intermolecular nucleophilic – electrophilic interactions.

UNIT–III(15 Hrs).

Heterocyclic Synthesis

Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions.

Small Ring Heterocycles

Three membered and four membered heterocycles- synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes.

UNIT –IV (15 Hrs.)

Benzo-Fused Five-Membered Heterocycles

Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans, and benzothiophenes.

Meso-Ionic Heterocycles

General classification, chemistry, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

Recommended Books

1. R.R. Gupta, M. Kumar and V. Gupta, 'Heterocyclic Chemistry: Principles, Three- and Four-Membered Heterocycles, Vol. 1', Springer Berlin Heidelberg,**1998.**
2. R.R. Gupta, M. Kumar and V. Gupta, 'Heterocyclic Chemistry: Five-Membered Heterocycles, Vol. 2', Springer Berlin Heidelberg,**1999.**
3. T. Eicher and S. Hauptmann, 'The Chemistry of Heterocycles', Georg Thieme,Stuttgart, **1995.**
4. J.A. Joule, K. Mills and G.F. Smith, 'Heterocyclic Chemistry', 5th Edn., John Wiley& Sons,**2010.**
5. T.L. Gilchrist, 'Heterocyclic Chemistry', 3rd Edn., Pearson Education India,**2007.**
6. G.R. Newkome and W.W. Paudler, 'Contemporary Heterocyclic Chemistry', Wiley-Inter Science, New York,**1982.**
7. R.M. Acheson, 'An Introduction to the Heterocyclic Compounds', John Wiley & Sons Ltd., New York, London,**1976.**
8. A.R. Katritzky and C.W. Rees, 'Comprehensive Heterocyclic Chemistry',Pergamon Press, Oxford,**1984.**

SEMINAR – II

Subject Code: MCHMS1-304 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

1. In the beginning of the semester, a teacher will be allocated maximum 30 students. The teacher will guide/teach them how to prepare/present 15 minutes Power Point Presentation for the Seminar.

2. If there are more than 30 students in the class, then class will be divided into two group shaving equal students. Each group may be allocated to a different teacher.

3. Each student will be allotted a topic by the teacher at least one week in advance for the presentation. The topic for presentation may be from the syllabus or relevant to the syllabus of the program.

4. During the presentation being given by a student, all the other students of his/her groupwill attend the Seminar. The assessment/evaluation will be done by the teacher. However, Head of Department and other faculty members may also attend the Seminar, ask questions and give their suggestions.

5. This is a turn wise continuous process during the semester and a student will give minimum two presentations in a Semester.

6. For the evaluation, the following criteria will be adopted,
(a) Attendance in Seminar: 25 Marks
(b) Knowledge of Subject along with Questions handling during the Seminar: 25 Marks
(c) Presentation and Communication Skills: 25 Marks
(d) Contents of the Presentation: 25 Marks.

SURFACE CHEMISTRY & CATALYSIS

Subject Code: MCHMD1-311 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course objective:
(1)To impart knowledge of applications of , surface reaction, adsorption and catalysis.
(2)To impart knowledge of metal catalysis, reagents and their current applications.

Course Outcome:
The students will acquire knowledge of
1. Fudmantal principles of surface chemistry, and their applications in industries.
2. Application of homogeneous and heterogeneous catalysis in chemical synthesis.
3. Importance of adsorption process and catalytic activity at the solid surfaces.
4.Experimental techniques for different catalytic reactions.
5. Various catalyst and their applications in industry.

UNIT-I (15 Hrs.)

Structural Aspects of Organized Molecular Assemblies

Surfactants, classification of surfactants, micelles, critical micellar concentration,different methods for determination of critical micellar concentration, thermodynamicsof micellization, aggregation number, shape & size and their determination, shapetransition, reverse micelles, emulsion, microemulsion (oil in water and water in oil),effect of cosurfactants, thermodynamics of microemulsion formation.

UNIT-II (15 Hrs.)

Analytical Applications of Organized Assemblies

Application of micellar systems for UV-Visible/fluorescence spectroscopic detection ofions, micellar enhanced phosphorescence and fluorescence, micellar systems in liquid liquid extraction, surfactant aggregates in flame and plasma atomic spectrometry,micellar systems in chromatography, recent developments in micellar chromatography,application of surfactants in gel electrophoresis.

UNIT-III (15 Hrs.)

Catalysts

Classification of catalysis to homogeneous and heterogeneous, Basic concepts in heterogeneous catalysis, catalyst preparation and catalyst characterization, Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration, enzymatic, phase transfer catalysis, influence of heat and mass transport on the rate of catalytic process. Evaluation of activity and selectivity of catalysts.

UNIT-IV (15 Hrs.)

Industrial Applications of catalysts

Industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis, Commercial catalytic reactors (fixed bed, fluidized bed, trickle-bed, slurry, etc.).
Heat and mass transfer and its role in heterogeneous catalysis. Calculations of effective diffusivity and thermal conductivity of porous catalysts. Reactor modeling. Emphasizes the chemistry processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis.

Reference books:

1. P.H. Emmet, Catalysis (Vol I and II), Reinhold, New York, 1954.
2. M. Schlosser, Organometallics in Synthesis, A manual, John Wiley, New York, 1996.
3. L.S. Hegedus, Transition Metals in the Synthesis of Complex Organic Molecules, University Science, Book, CA, 1999.
4. D.K. Chakrabarty and B. Viswanathan, Heterogeneous Catalysis, New Age, 2008.
5. B. Viswanathan, S. Kannan, R.C. Deka, Catalysts and Surfaces: Characterization Techniques, Narosa, New Delhi, 2010.
6. M. Kaneko, I. Okura, Photocatalysis: Science and Technology, Springer, 2003.
7. Text Book of Physical Chemistry Vol-1-4 by K.L. Kapoor
8. Physical Chemistry by D.N. Bajpai
9. Physical Chemistry by A.W. Atkins

MEDICINALCHEMISTRY

Subject Code: MCHMD1-312 **L T PC** **Duration: 60Hrs.**
4 0 0 4

Course Objectives

1. To understand types, classification, structural activity of various antibacterial, Antiviral and Antimalarialagent.
2. To know the synthetic procedures for Chloroquine, amodiaquine, mefloquine and sontoquine.
3. To familiarize with CNS depressant and CNSstimulants.
4. To know the synthetic procedure for thioridazine, haloperidol,diazepam.

Course Outcomes:
The students will acquire knowledge of

1. Different antimicrobialagents.
2. Synthetic procedures for antimalarialdrugs.
3. Importance of CNS-stimulants and psychoactive drugs anddiuretics.

UNIT-I (15 Hrs.)

1. Antibacterial and Antiviral Agents

History of antibacterial drugs, types, classifications, structural activity relationship, fluoroquinolones. Mechanism of action of antibacterial, ß-lactams, bacterial resistance against antibacterial drugs. Target for anti HIV drugs, anti HIV agents, HIV-protease inhibitors, amprenavir, foseprenavir, alazanavir etc., anti-HIV nucleosides: lamivudine, retrovir, videx, hivid, zlarit, viread, carbovir, delavirdine, ziduvidine, etavirenz, calanolide, capravine, nevirapine. DNA polymerase inhibitors: acyclovir, ganciclovir, penciclovir, famicilovir, valaciclovir, valomaciclovir, codofvir.

UNIT-II(15 Hrs.)

2. Anti-malarials

Cinchona alkaloids, 4-aminoquinolines, 8-aminoquinolines, pyramidines and sulfones, 9-aminoacridines, biguanides, mefloquine, sulfonamides.

3. Commercial Synthetic Routes to

Chloroquine, pamaquine, primaquine, proguanil, amodiaquine, mefloquine, pyremethamine, sontoquine.

UNIT-III (15 Hrs.)

4. CNS Active Drugs: **CNS depressants: Hypnotics and Sedatives**

Barbiturates, non-barbiturates, amides and imides, glutethimide, benzodiazepines, aldehydes and derivatives, methaqualone and other miscellaneous agents.

5. Anticonvulsants

Barbiturates, hydanatoins, oxazolidinediones, succinimides, bezodiazepines, thenacemide, glutethimide.

6. CNS-Stimulants & Psychoactive Drugs

Analeptics, purines, psychomotor stimulants, sympathomimetics, monamine oxidase inhibitors, tricyclic antidepressants, miscellaneous psychomotor stimulants. Hallucinogens (psychedelics, psychometrics): Indolethylamines, R-phenylethylamines, butyrophenones and other miscellaneous drugs.

7. Commercial Synthetic Routes to

Thioridazine, haloperidol, chloropromazine, phenytoin, Phenobarital, Carbamazipinevalproic acid, methaquolane, nitrazepam, oxazepam, diazepam, cholridazepoxide.

UNIT-IV (15 Hrs.)

8. Diuretics

Osmotic agents, acidifying salts, mercurials, purines and related heterocycles, sulfonamides, benzothiadiazene and related compounds, chlorothiazides and analogs, sulfamoylebenzoic acid and analogs, endocrine antagonists, miscellaneous diuretics.

9. Commercial Synthetic Routesto

Furosemide, methalthiazidemethylchlothlazide: Chlorothiazide, triameterene, hydrochlothiazide, ameloride, chlorthalidone.

Recommended Books

1. Wilson and Gisvolds, 'Textbook of Organic Medicinal and Pharmaceuticals Chemistry', 8th Edn., edited by R.F. Deorge, J.B. Lippincott Company, Philadelphia,**1982**.
2. B.G. Reuben and H.A. Wittcoff, 'Pharmaceutical Chemicals in Perspective'**,** John Wiley & Sons, New York,**1989**.
3. W.O. Foye, T.L. Lamke, D.A. Williams, 'Principles of Medicinal Chemistry'**,** 5thEdn.Lippencott Williams and Wilkins,**2002**.

GREEN CHEMISTRY

Subject Code:MCHMD1-313 **L T P C** **Duration: 60 (Hrs.)**
4 0 0 4

Course Objectives:

1. To understand the importance of ultrasound and microwaves in organicsynthesis.
2. To understand the role of ionic liquids in organicsynthesis.
3. To familiarize with phase transfer catalysis and crownethers.
4. To study the mechanistic aspect of aqueous phase reactions.

Course Outcomes:

The students will acquire knowledge of

1. Use of ultrasound and microwave in Green Chemistry.
2. Importance of ionic liquids in green syntheses.
3. Advantages of phase transfer catalyst and crown ethers in green reactions.

UNIT-I (15 Hours)

Use of Ultrasound in Organic Synthesis:

Introduction, instrumentation, the phenomenon of cavitation, Sonochemical esterification, Saponification, Hydrolysis, Substitution Reactions, Addition Reactions, Alkylations, Oxidation, Reduction, Hydroboration, Coupling Reactions, Fridel-Crafts Reaction, Diels-Alder Reaction, Simon-Smith Reaction, Bouveault Reaction, Cannizaro Reaction, Strecker Synthesis, Reformatsky Reaction, Conversion of Ketones into Tertiary Alcohols, Synthesis of Chromenes.

Use of Microwaves in Organic Synthesis-Introduction, concept, reaction vessel and medium, advantages and limitations, Microwave Assisted Reactions in Water-Hofmann Elimination, Hydrolysis, Oxidation of Toluene, Oxidation of Alcohols. Microwave Assisted Reactions in Organic Solvents- Esterification, Fries Rearrangement, Diels Alder Reaction, Synthesis of Chalcones, Decarboxylation. Microwave Assisted Solvent Free Reactions (Solid State Reactions)- Alkylation of Reactive Methylene Compounds, Condensation of Active Methylene Compounds with Aldehydes, Synthesis of Nitriles from Aldehydes, Synthesis of Anhydrides from Dicarboxylic Acid, Reductions, Synthesis of Heterocyclic Compounds.

UNIT-II (15 Hours)

Ionic-liquids:

Introduction, structure, synthesis of some important ionic liquids, Applications of ionic liquids in Hydrogenations, Diel's-Alder Reaction, Heck Reaction, *O*-Alkylation and *N*-alkylation, Methylene Insertion Reactions, Miscellaneous Applications, Synthesis of Pharmaceutical Compounds.

Polymer supported Reagents in Organic Synthesis:

Introduction- properties of polymer support, advantages of polymer supported reagents Applications of Polymer Supported Reagents-Polymer Supported Peracids, Polymer Supported Chromic Acid, Polymeric Thioanisolyl Resin, Poly-*N*-Bromosuccinimide (PNBS), Polymeric Organotin Dihydride Reagent as a Reducing Agent, Polystyrene Carbodiimide, Polystyrene Anhydride, Sulfonazide Polymer, Polystyrene Wittig Reagent, Polymeric Phenylthiomethyl Lithium Reagent, Polymer Supported Peptide Coupling Agent. Polymer Supported Catalysts-Polystyrene aluminium Chloride, Polymeric Super Acid Catalysts, Polystyrene-metalloporphyrins, Polymer Supported Photosensitizers.

UNIT-III (18 Hours)

Phase transfer catalysis and Crown Ethers :

Phase Transfer Catalysis: Introduction, definition, mechanism of phase transfer catalysis. Applications of PTC in Organic Synthesis- Nitriles from Alkyl or Acyl Halides, Alkyl Flurides from Alkyl Halides, Generation of Dihalocarbenes, Generation of Vinylidene Carbenes, Elimination Reactions, C-Alkylations, C-Alkylation of Activated Nitriles, C-Alkylation of Activated Ketones, C-Alkylation of Aldehydes, N-Alkylations, N-Alkylation of Aziridines, N-Alkylation of β-Lactams, S-Alkylation, Darzen's Reaction, Williamson's Ether Synthesis, Wittig Reaction, Sulphur Ylides.

Crown ethers: Introduction, nomenclature, features, nature of donor site. General synthesis of Crown ethers. Applications of crown ethers-Esterification, Saponification, Anhydride Formation, Potassium Permanganate Oxidation, Aromatic Substitution Reaction, Elimination Reaction, Displacement Reaction, Generation of Carbene, Superoxide Anion Reaction, Alkylation.

UNIT-IV (12 Hours)

Aqueous Phase Reactions:

Studies on the mechanistic aspects and use of the following reactions in organic synthesis: Diels-Alder Reaction, Claisen Rearrangement, Wittig-Homer Reaction, Michael Reaction, Aldol Condensation, Knoevenagel Reaction, Pinacol Coupling, Benzoin Condensation, Claisen-Schmidt Condensation, Heck Reaction, Strecker Synthesis, Wurtz Reaction, Expoxidation and Dihydroxylation, Oxidations and Reductions.

Recommended Text Books / Reference Books:

1. V.K. Ahluwalia and M. Kidwai, New trends in Green Chemistry, Anamaya Publishers, New Delhi, **2004**.
2. R. Sanghi and M.M. Srivastava, 'Green Chemistry, Environment FriendlyAlternatives', Narosa, New Delhi,**2003.**
3. 'Green Chemistry-An Introduction Text', Royal Society of Chemistry, UK,**2002**.
4. G.W. Gokel, 'Crown Ethers & Cryptands', Monograph, The Royal Society of Chemistry,**1991.**
5. G.W. Gokel, S.M. Korzeniowski, 'Macrocyclic Polyether Chemistry', Vol 1 to 3, Wiley, NY, **1978, 1981,1987**.
6. W.B. Weber, G.W. Gokel, 'Phase Transfer Catalysis in Organic Synthesis', Springer, Berlin, **1977**.
7. E.V. Dehmlov, S.S. Dehmlov, 'Phase Transfer Catalysis', 2nd Edn., VerlagChemie, Wienheim, **1983**.
8. N.K. Mathur, C.K. Narang and R.E. Williams, 'Polymers as Aids in OrganicSynthesis', Academic Press, NY,**1980**.

ORGANIC REACTION AND MECHANISM Lab - II

Subject Code: MCHMS1-305	L	T	P	C	Duration: 60(Hrs.)
	0	0	4	2	

Note:
1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

Course Objectives:

1. To introduces the basic techniques and procedures in isolation,purification.
2. To understand Beckmann and Benzilic acid rearrangement.
3. To learn various practical synthetic methods.
4. To prepare Cinnamic acid, Chalcone,phenacetin..

Course Outcomes:

The students will acquire knowledge of

1. Syntheses of various organiccompounds.
2. Purification and isolation ofcompounds

1. BeckmanRearrangement

a) Benzene-Benzophenone Benzophenone Oxime Benzanilide
b) Benzene AcetophenoneAcetophenoneOxime-Acetanilide.
c) CyclohexanoneOxime-Caprolactam.

2. Benzylic acidRearrangement

a) Benzoin-Benzil-Benzylic-acid.
b) Benzoin-Benzil-Benzilmonohydrazone.

3. Fischer IndoleSynthesis

a) N-Arylmaleinilic acid N-arylmaleimide.
b) 1, 2, 3, 4-Tetrahydrocarbazole.
c) 2-Phenylindole fromPhenylhydrazone.

4. Other OrganicPreparations

a) Cinnamic acid by Perkinreaction.
b) Chalcone by aldolcondensation.
c) Ethylp-aminobenzoate(benzocaine).
d) Preparation of Benzopinacolone by Pinacol-Pinacolonerearrangement.
e) Synthesis ofN-phenylmaleimide.
f) Preparation ofp-bromoaniline fromacetanilide.
g) Preparation of phenacetin fromp-aminophenol.
h) Preparation of eosin from phthalicanhydride.
i) Preparation of p-chlorobenzoic acid fromp-toluidine.

Recommended Text Books / Reference Books:

1. 'Vogel's Text Book of Practical Organic Chemistry', 5th Edn., Prentice Hall,**1996**.
2. Julius B. Cohen, 'Practical Organic Chemistry',**1910**.
3. David T. Plummer, 'An Introduction to Practical Biochemistry', 3rdEdn., TataMcGraw Hills,**1998**.
4. A.I. Vogel, 'Text Book of Practical Organic Chemistry', 5th Edn., PearsonEducation, **2005**.
5. P.R. Singh, D.S. Gupta and K.S. Bajpai, 'Experimental Organic Chemistry', Vol 2, Tata McGraw Hill, **1981**.

6. G. Mann and B.C. Saunders, 'Practical Organic Chemistry', ELBS Edn.,**1989**.
7. N.K. Vishnoi, 'Advanced Practical Organic Chemisry', 2nd Edn., Vikas PublishingHouse Pvt. Ltd.,**1994**.

PHYSICAL CHEMISTRY LAB – I

Subject Code: MCHMS1-306 | **L T P C** 0 0 4 2 | **Duration: 60(Hrs.)**

Course Objectives:

1. To develop basic understanding of data analysis and reporting of results.
2. To calculate various physical parameters while performing experiments.

Course Outcomes:

The students will acquire knowledge of

1. Surface adsorption phenomena while performing experiments.
2. Various physical parameters.
3. Conductivity related phenomena.

Note:

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

Experiments

1. Determination of accuracy, precision, mean deviation, standard deviation, coefficient of variation, normal error curve and least square fitting of certain set of experimental data in an analysis. Composition of two sets of results in terms of significance (Precision and accuracy) by (i) student's t-test, (ii) F-test
2. Determination of ferrous ammonium sulfate potentiometrically with standard ceric sulfate solution (Direct and back titration).
3. To prepare a buffer solution of known ionic strength and to find its maximum buffer capacity.
4. Titrate a tribasic acid (phosphoric acid) against NaOH and $Ba(OH)_2$conductometrically.
5. To determine the equivalent weight of iron by the chemical displacement method. The equivalent weight of copper is 63.5.
6. Determination of partition coefficient of benzoic acid between benzene and water, and hence show that benzoic acid dimerises in benzene.
7. Determine the specific rate constant for the acid catalysed hydrolysis of methyl acetate by the Initial Rate Method.
8. Determination of surface tension of given liquid by drop no. method by stalagmometer.
9. Compare the strengths of hydrochloric acid and sulphuric acid by studying the rate of hydrolysis of methyl acetate.
10. To determine the composition of a mixture of two liquids by surface tension measurements.
11. Determine the equivalent conductance at infinite dilution for acetic acid by applying Kohlrausch's law (b) Determine the equivalent conductance, degree of dissociation and dissociation constant (Ka) of acetic acid.
12. To verify Freundlich and Langmuir Adsorption isotherms for adsorption of acetic acid on activated charcoal.
13. Study the conductometric titration of hydrochloric acid with sodium carbonate and determine the concentration of sodium carbonate in a commercial sample of soda ash.
14. Study the stepwise neutralization of a polybasic acid e.g. oxalic acid, citric acid, succinic

acid by conductometric titration and explain the variation in the plots.

15. Titrate a moderately strong acid (salicylic/mandelic acid) by the (a) salt-line method (b) double alkali method.
16. Study the effect of dielectric constant (ε) on the nature of the conductometric titration between maleic acid and sodium methoxide using different mixtures of benzene and methanol as solvents.
17. Determine the dissociation constant of an indicator spectrophotometrically.
18. Verification of Beer's law and calculation of molar absorption coefficient using $CuSO_4$ and $KMnO_4$ solutions.
19. To determine the the equivalent conductance of a weak electrolyte at infinite dilution using Kohlraush law.
20. To study the current-potential characteristics of Cd^{2+} ions using DC polarography, sampled DC, cyclic voltammetry and pulse polarographic technique

Recommended Text Books / Reference Books:

1. A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.
2. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
3. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.
4. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
5. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, 1962.
6. R.C. Das & B. Behera, 'Experimental Physical Chemistry', Tata McGraw Hill, Publishing Co. Pvt. Ltd., 1993.
7. D.P. Shoemaker, C.W. Garland & J.W. Nibler, 'Experiments in Physical Chemistry', McGraw Hill, New York, 1996.
8. R.A. Day, Jr. & A.L. Underwood, 'Quantitative Analysis', 3rd Edn. Prentice-Hall India Pvt. Ltd., New Delhi, 1977.
9. D.T. Burns & E.M. Ratenbury, 'Introductory Practical Physical Chemistry', Pergamon Press, 1966.
10. D.T. Burns & E.M. Ratenbury, 'Introductory Practical Physical Chemistry', Pergamon Press, 1966.
11. D.C. Harris, 'Quantitative Chemical Analysis', 6th Edn., W.H. Freeman & Co., 2002.

PHOTOCHEMISTRY AND PERICYCLIC REACTIONS

Subject Code: MCHMS1-401 **L T PC** **Duration: 60Hrs.**
4 0 0 4

Course Objectives

1. To discuss molecular organic photochemistry and pericyclicreactions.
2. To focus on primary photochemical reactions of n, π*states.
3. To lay emphasis on primary photochemical reactions of π, π*states.
4. To study some important applications of photochemistry.

Course Outcomes:

After completion of the course the student be will able to:1. Acquire basic knowledge of pericyclic reaction.2. Solve the problems of pericyclic reactions.,3.Acquire basic knowledge of principle and application of photochemical reaction.

UNIT-I (15 Hrs.)

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5- hexatriene, allylsystem, classification of pericyclic reactions, FMO approach. Woodward-Hoffmann correlation diagrams method and Perturbation of molecular orbital (PMO) approach for explanation ofpericyclic reactions under thermal and photo-chemical conditions.
Electrocyclic reactions – controtatory and disrotatory motions, 4n, 4n+2, allyl systems, Electrocyclic rearrangement of cyclobutenes and 1,3 cyclohexadienes.
Cycloadditions – antrafacial and suprafacial additions, notation of cylcoadditions (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+2) cycloaddition-stereochemicaleffects and effects of substituents on the rates of cycloadditions, 1,3-dipolar cyclo-additions.

UNIT-II (15 Hrs.)

Sigmatropic Rearrangements-suprafacial and antrafacial shifts [1,2]- sigmatropic shifts involving carbon moieties retention and invertion of configuration, (3,3) and (5,5) sigma-tropic rearrangements, detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-cope rearrangements, cheleotropic reactions, Ene and retro ene reactions, Ene and retro ene reactions, Coarctate reaction, simple problems on pericyclic reactions.

UNIT-III (15 Hrs.)

Introduction to organic photochemistry: Laws of photochemistry, Jablonski diagram

Photochemistry of Carbonul compounds: Primary photochemical reactions of n, π* states. Electronic energy transfer. Detail analysis of primary photochemical process of α-cleavage. Detail analysis of primary photochemical process of α- cleavage. Detail analysis of primary photochemical process of hydrogen abstraction. Detail analysis of primary photochemical process of electron transfer reactions. Norrish type-I and Norrish type –II reaction, Paterno Buchi Reaction.

UNIT-IV (15 Hrs.)

Primary photochemical reactions of π, π*states. Detail analysis of cis-trans isomerization. Study on di- π-methane rearrangement,Photochemistry of aromatic compounds, Photochemical reaction of azo compounds. Photochemical Oxygenations-Singlet Oxygen. Photochemistry of halogen containing compounds. Photoinduced electron transfer reactions. Factors influencing the course of photochemical reaction. Applications of photochemistry.

Recommended Books

1. J.C. Calvert and J.N. Pitts, Jr., 'Photochemistry', Wiley, New York,**1966**.
2. N.J. Turro, 'Modern Molecular Photochemistry', (MMP), University Press, Menlo Park, CA, **1978**.
3. A. Gilbert and J. Baggott, 'Essentials of Molecular Photochemistry', CRC Press,London, UK,**1991**.
4. J. Mattay and A. Griesbeck, eds., 'Photochemical Key Steps in Organic Synthesis', VCH, New York,**1994**.
5. J.D. Coyle, Edn., 'Photochemistry in Organic Synthesis', Royal Society ofChemistry, London,**1986**.
6. W.H. Horspool, Edn., 'Synthetic Organic Photochemistry', Plenum, New York,**1984**.
7. Bryce-Smith, et. al, eds. 'Specialist Reports of the Chemical Society: D. Photochemistry (Annual reports on all of photochemistry since1969)'.
8. I. Ninomiya and T. Naito, eds., 'Photochemical Synthesis', Academic Press,London, **1989**.
9. J.C. Scaiano, Edn., 'CRC Handbook of Organic Photochemistry', vol. 1 and 2, CRC Press, Boca Raton, Florida,**1989**.
10. JagdambaSingh and Jaya Singh, Photochemistry and pericyclic reaction New Age International Publication,**2019.**

BIO-INORGANICCHEMISTRY

Subject Code: MCHMS1-402 **L T PC** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives

1. To understand structures, processes and chemical interactions of enzymes with metalions in biologicalsystems.
2. To understand the transport mechanisms of enzymes in physiologicalsystems.
3. To acquire knowledge of metal complexes with various nucleicacids.
4. To study the role of metal complexes in transcription of nucleicacid.

Course Outcomes:

After completion of the course the student be will able to:

1. Structures, properties and transport mechanisms of enzymes in physiological systems.
2. Metal complexation with various nucleic acids and their role in transcription of nucleic acids.
3. Basic Knowledge of porphyrins and their functions.

UNIT-I (15Hrs.)

Introduction, non-photosynthetic processes, structure of metallo-porphyrines, cytochromes, structure and function of haemoglobin, nature of heme-dioxygen binding, cooperativity in haemoglobin, Bohr effect and Heldane effect. physiology of myoglobin and haemoglobin, structure and function of myoglobin, comparision of haemoglobin and myoglobin.

UNIT-II (15Hrs.)

Structure and function, inhibition and poisoning Vitamin B12 and B12 coenzymes, nitrogen fixation, in-vitro and in-vivo nitrogen fixation, Nitrogenases, Other iron- prophyrin biomolecules, Peroxidase and catalases, cytochrome P450 enzymes. other natural oxygen carriers: hemerythrins, hemocyanine. Electron transfer system: respiration and photosynthesis, ferridoxins, and subredonim carboxypeptidase, carbonic anhydrase.

UNIT-III (15Hrs.)

Metal complexes of polynucleotides, nucleosides and nucleic acids (DNA & RNA). Template temperature, stability of DNA. Role of metal ions in replication and transcription process of nucleic acids. Biochemistry of calcium as hormonal messenger, muscle contraction blood clotting, neurotransmitter, calcification reclaiming of barren land.

UNIT-IV (15Hrs.)

Biochemistry of iron, iron storage and transport, ferritin transferring, bacterial iron transport, Bio-inorganic chemistry of Mo, W, V, Cr and Ni (essential and trace elements in biological systems). Metals in the regulation of biochemical events. Transport and storage of metal ions *in vivo*. metallothioneins.

Recommended Books

1. J.E. Huheey, E.A. Keiter and R.L. Keiter, 'Inorganic Chemistry: Principles of Structure and Reactivity', 4th Edn., HaperCollins.
2. B. Douglas, D. McDaniel and J. Alexander, 'Concepts and Models of Inorganic Chemistry', 3rd Edn., John Wiley andSons.
3. F.A. Cotton and G. Wilkinson, 'Advanced Inorganic Chemistry: A Comprehensive Text', 5TH EDN., JOHNWILEY.
4. Ch. Elschenbroich and A. Salzer, 'Organometallics. A Concise Introduction', 2nd Edn.,

VCH.
5. D.F. Shriver and P.W. Atkins, 'Inorganic Chemistry', 3rd Edn., Oxford UniversityPress.
6. J.A. Cowan, 'Inorganic Biochemistry', 2nd Edn.,Wiley-VCH.
7. G. Wulfsberg, 'Inorganic Chemistry', University ScienceBooks.
8. S.J. Lippard& J.M. Berg, 'Principles of Bioinorganic Chemistry',Univ. ScienceBooks, **1994**.
9. S.J. Lippard, 'Progress in Inorganic Chemistry', Vols. 18, 38, Wiley-Interscience,**1991**.

RESEARCH METHODOLOGY

Subject Code– MREM0-101 **L T PC** **Duration – 60 Hours**

4 0 0 4

UNIT–I (15 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, FactorialDesign.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (15 Hrs)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (15 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (15 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education NewDelhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, NewDelhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', HimalayaPublishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
6. C.R.Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age InternationalPublishers.

PHYSICAL CHEMISTRY LAB – II

Subject Code: MCHMS1-403 **L T P C** **Duration: 60(Hrs.)**
0 0 4 2

Course Objectives:

1. To develop basic understanding of various lab practices including safety measures.
2. To calculate various physical parameters while performing experiments.

Course Outcomes:

The students will acquire knowledge of

1. Colligative properties and phase rule while performing experiments.
2. Various physical parameters.

Note:

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

Experiments

1. To determine the atomic parachor of C, H, Cl and Br by surface tension measurements.
2. Determination of heat of solution of a substance by solubility method.
3. To construct phase diagram of 3-component system ($CH_3COOH + CHCl_3 + H_2O$).
4. To prepare arsenious sulphide/Ferric hydroxide Sols and study Hardy – Schulze's rule for it.
5. To determine the relative strength of acids by study kinetics of hydrolysis of an ester.
6. To determine the iodine value of given sample of oil (Linseed oil).
7. To determine the saponification value of given sample of oil (Ground nut oil).
8. To obtain the mutual solubility curve of phenol + H_2O, and hence the Upper Consolute Point.
9. To determine parachor of a mixture of two liquids.
10. To determine the coefficient of viscosity of given liquid by Ostwald's viscometer.
11. To compare cleansing powers of two samples of detergent.
12. To determine the C.M.C. of a soap (sodium or potassium lauryl sulphate) by surface tension measurements
13. To determine the distribution coefficient of I_2 between CCl_4 and H_2O.
14. To study the variation of viscosity with composition of the mixture of liquids.
15. Determination of pH of a mixture of CH_3COOH and CH_3COONa, and hence to calculate dissociation constant of the acid.
16. To titrate Fe(II) with $KMnO_4$ spectrophotometrically.
17. To determine the composition of binary mixture containing $K_2Cr_2O_7$ and $KMnO_4$ using spectrophotometer.
18. To study the variation of solubility of $Ca(OH)_2$ in NaOH solution, and hence determine the solubility product.
19. Spectrophotometric determination (in ppm) of Fe (II) or Fe(III) using 1,10 Phenanthroline (or thiocyanate) as colorimetric reagent.
20. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid.

Recommended Text Books / Reference Books:

1. 'Findlay's Practical PhysicalChemistry'.
2. J.B. Yadav, 'Advanced Practical PhysicalChemistry'.
3. L.V. Cock and C. van Rede, 'Laboratory Handbook for Oil & FatAnalysis'.
4. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
5. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.

DISSERATION

Subject Code: MCHMS1-404 **L T P C**
0 0 8 4

M.Sc. 4th Semester will carry the dissertation work under the supervision of the assigned project guide as per following scheme:

Format for writing dissertation work: The students will write the report in Times New Roman, with font size 12 and 1.5 spacing.

1. Title of the M.Sc. Dissertation Work	7. Introduction
2. Self-Declaration Certificate of Original Work	8. Methodology
3. Acknowledgement	9. Results and Discussion
4. Content	10. Conclusion
5. List of Tables	11. References
6. List of Figures	12. Student's Bio data

Evaluation Criteria: The maximum marks allotted for the dissertation will be 100 which comprises of internal evaluation of 60 marks and external evaluation of 40 marks. The details of internal and external evaluation are given below:

(A) Internal Evaluation:(MM: 60)

The students will be evaluated based on regular performance, attendance and presentation. He/She should give power point presentation of their detail work during the mid-semester ($1^{st}$and 2^{nd}) examinations.

Final Submission Report:

The student will submit the final report as hard bound copies (03) and soft copy on CD/DVD. The internal awards will be given to the students after final submission of the report by the dissertation supervisor.

(B) External Evaluation: (MM:40)

Evaluation will be done based on originality and quality of work, knowledge and presentation skills etc. The students should give presentation through power point slides in front of a internal panel of three examiners including dissertation Supervisor, Head/Nominee and other faculty member of the Department as constituted by Head of the Department.

TERM PAPER

Subject Code: MCHMS1-405 **L T P C**
0 0 8 4

1. Evaluation of Term Paper will be internal and will be done by the three member Departmental Commttee constituted by HOD.

2. Four different heads have been classified for evaluation purpose and weightage is as follows:

(a) Literature survey 40%

(b) Writing of paper/format 20%.

(c) Presentation 20%

(d) Knowledge of subject 20%

3. Every student will submit hard copy of research papers reviewed by him/her for writing Term Paper.

4. Every teacher will give format of a particular journal to the student for writing the Term Paper.

5. A time slot will be provided in the time table to carry out literature survey for Term Paper. Permission can be sought from particular Institution to provide access to library facility, if needed by students.

6. The whole process of writing Term Paper will be a time bound activity and a time line will be framed with fixed dates and milestones.

ADVANCED LAB

Subject Code: MCHMS1-406 | **L T P C** 0 0 4 2 | **Duration: 60(Hrs.)**

Course Objectives

1. To provide knowledge of various methodologies for synthesis of target molecules
2. To acquaint the students with characterization of synthesized molecules by spectroscopy techniques.
3. To provide knowledge of extraction of organic compounds from natural sources.

Course Outcomes

The students will acquire knowledge of

1. Structure elucidation of unknown compounds *via* interpretation of the spectra (NMR, UV &MS).
2. Various reactions conditions including modern reaction strategies and theirimplications

Note:

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

EXPERIMENTS

1. Extraction of organic compounds from naturalsources
   a) Isolation of caffeine from tealeaves
   b) Isolation of piperine from blackpepper
   c) Isolation of lycopene from tomatoes

2. Preparations:
   a) Synthesis of anthranilic acid fromphthalimide.
   b) Preparation of 2-phenylindole fromphenylhydrazine.
   c) Synthesis of 2-phenyl-1,3,4-oxadiazole frombenzhydrazide
   d) Synthesis and reactivity of benzalacetophenone

3. Reactions of alkenesand *α, β*-unsaturated compounds

   a) Bromination& subsequent debromination
   b) Epoxidation and ring opening with hydroxide ion
   c) Michael addition reactions of *α, β*-unsaturated compounds

4.Preparation and characterization of the Aldol-dehydration products *via* following aldehydes and ketones

a) Aldehydes:benzaldehyde, 4-methylbenzaldehyde, 4 methoxybenzaldehyde.

b) Ketones: acetone, cyclopentanons, cyclohexanone

RECOMMENDED BOOKS

1. L.M. Harwood and C.J. Moody, 'Experimental Organic Chemistry', 1st Edn., Blackwell Scientific Publishers,**1989**.
2. A.I. Vogel, 'Textbook of Practical Organic Chemistry', 6th Edn., ELBS, Longman Group Ltd.,**1978**.
3. F.G. Mann and B.C. Saunders, 'Practical Organic Chemistry', 4th Edn., New Impression, Orient Longman Pvt. Ltd.,**1975**.

4. A. Viswas and K.S. Tewari, 'A Textbook of Organic Chemistry', 3rd Edn.,Vikas Publishing House,**2009**.
5. J. Leonard and B. Lygo, 'Advanced Practical Organic Chemistry', Chapman andHall, **1995**.
6. W.L. Armarego and C. Chai, 'Purification of Laboratory Chemicals', Butterworth Heinemann,**2012**.
7. J.A. Young, 'Improving Safety in the Chemical Laboratory: A Practical Guide', 2nd Edn., Wiley Publishing,**1991**.